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Editorial.

GLANDERS AND THE BRITISH ARMY. VALUE OF THE ARMY VETERINARY SERVICE

GLANDERS, that scourge of horseflesh, *the* disease (without exception) which has in all past wars where horses were employed been considered to be the most dangerous and most dreaded, is practically non-existent in the British cavalry, artillery, and transport horses in France.

For this, if for nothing else, the Army Veterinary Service can legitimately be stated to have justified its existence ; and it can claim not only to have saved the country many millions of pounds and to have enabled the operations of war to be carried on in a manner which would otherwise have been impossible, but also to have saved many human lives as well. Everyone knows that Glanders is contagious from horses to men, and that to the latter, when infected, it means certain death.

Hundreds of thousands of horses, gathered from all parts of the world and in almost every instance from countries where Glanders is rife, are now employed in the British Area alone, and for several months the returns have been almost *nil*. To be able to substantiate such a statement is a great triumph, and the organisers of the regulations and the methods which have brought about such a successful state of affairs deserve the warmest possible congratulations.

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Those of us who have had intimate contact with Glanders in London and other large cities in the pre-mallein days know full well the devastation which a few undetected cases of this disease can cause in a large stud of horses in peace time; but in a war like this the chances of infection—had glanders not been under control—both to horses and to men would be increased a thousand-fold.

For an idea as to how serious a disease it is considered in Great Britain one has only to read the stringent laws and regulations of the Board of Agriculture or the London County Council on this subject and to study their returns. In Great Britain about 8,000 horses were destroyed for this disease alone between 1886 and 1890; whilst in France and Germany respectively, during the same period, in each country the total losses amounted to nearly 6,000 infected cases.*

In German territory there were officially notified, during the years 1886 to 1902, 12,780 horses as suffering from Glanders, and between 1876 and 1886 20,566 horses died of Glanders in Prussia alone, or were killed on account of having the disease. There were twenty known cases of the disease having been transmitted to man, three of the victims being veterinary surgeons.

In Saxony, a travelling circus was proved to have infected seventeen localities within the space of two years—a further proof, if any were needed, of the great watchfulness necessary, and the need for proper skilled veterinary supervision in all our mounted units, which must of necessity move from one area to another and occupy billets just vacated by other mounted units.

Between 1877 and 1887, 3317 were officially reported as glandered in Austria; and in Hungary in 1897—8, 2459 in one year alone; the statistics gave 1700. The above figures illustrate the prevalence of this dire disease in peace time, but in war time its ravages have always been greater, *i.e.* before the wonderful uses of mallein were discovered; and now, in the greatest and most terrible war the world has ever known, its ravages are readily controlled and its disastrous effects made practically non-existent.

For this result alone—even if there was nothing to place alongside it—the organisers of the British Veterinary Service can be said to have "done their bit"; and it is to them and to the loyal co-operation of their colleagues, the British Veterinary Officers, that this is due. They have justified their existence as a useful unit in "the contemptible little army."

Mallein, used by the skilled veterinarian with proper judgment and discretion, has saved the British taxpayer millions of pounds, and what would have happened to our horses without its aid in a war

* These statistics are taken from Friedberger & Frohners' Veterinary Pathology.

like that in which we are now engaged, and without the professional knowledge and skill of the Army Veterinary Service, is too terrible to contemplate.

ARE WE DOING OUR BEST?

THE Army Veterinary Department is again compelled to advertise the fact that more Officers are needed to enable its branch of the Service to be satisfactorily carried on; and it can be taken as pretty well assured that the request for more volunteers would not have been made had they not been needed badly. To the thinking man the question which at once flashes across one's mind is whether or not in the first place the profession has come forward sufficiently well to be considered to have done its duty; and, secondly, whether the Officers at present in the Army are having their services utilised to the best advantage. As regards the former, we have, according to the Register, about 3,300 qualified veterinary surgeons.

Out of these the following are the figures which demonstrate the approximate numbers of Veterinary Officers actually serving.

Regular A.V.C.	182
Retired A.V.C. now temporarily employed	9
Special Reserve	87
Indian Civil	5
Territorial	283
Temporary Commissions	519
	1,085

Taking the number actually on the Register at 3,030, this leaves a balance of some 2,215 members of the profession not yet enrolled.

One must not omit to mention that there are quite a substantial number of Canadian and Australian graduates whose help to the Corps is much appreciated, but even with the help of graduates from our Colonies we are still short.

It is for us to think how those 2,215 men are otherwise employed, and what can be the reason that they do not join up. Some are voluntarily stopping at home to set their principals free; some are over military age; and the patriotic ones in these categories are helping in war work of one kind or another, perhaps looking after a Remount Depot or a Military Hospital in the capacity of civilian practitioner.

Suppose we put those who are over age or incapacitated from accident or illness at one half of those remaining, this still leaves about 1,100 to account for—where are they? Until compulsory service is enforced there are some who will not budge. Established in

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comfortable practices and getting fresh clients every day owing to the lack of competition, they grow fat in flesh and pocket, and towns and districts are still to be found, of moderate size only, in Great Britain and Ireland, where there are two or even three practitioners, whereas one alone could " carry on."

Wherein does the fault lie ? When England needs them none should stand aside, and lessons in this respect might well be taken from our Continental Allies. The time is ripe for a definite mobilisation of the profession, and if we do not, in this respect, set our own house in order, the whole matter will be taken out of our hands and relegated to powers whose compulsory claims will *have* to be attended to in a far different and more irksome manner than at present. To the civilian the war is always irksome, but we have no option here, for the foe we have to deal with is relentless, and to keep from under his heel it is absolutely necessary that everyone shall do his bit. Let us each ask ourselves the question and answer it conscientiously—" are we doing our bit ? "

Original Communications.

THE MAINTENANCE REQUIREMENTS OF HORSES AND THE THERMIC AND DYNAMIC VALUES OF THEIR FOOD-STUFFS.

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To estimate, even within a wide range of latitude, the amount of energy expended daily by working horses is a matter of some speculation ; the reasons for the uncertainty of the estimate are so sufficiently obvious as not to need detailing.

If one were to calculate the number of foot-tons of energy expended daily by a stud of horses and thereon to formulate a feeding standard for the guidance of the stable-manager, the error involved might be considerable in either direction. The intelligent stable foreman, with a full experience of the food required by his charges for the work they do, adjusts their rations until he finds that his mature horses are in a condition of weight stasis ; his horses once in flesh remain so, and effectively do the work required of them.

It may happen, and without question frequently does, that the ration fixed upon by the horse-keeper fails to supply enough energy for the daily requirements ; if under these conditions the veterinary adviser is asked to adjust the dietary, he must estimate to the best of his ability the daily energy expenditure, and increase the supply of nutrients until a satisfactory ration is found. Having done so he is in a position to calculate with some accuracy the daily energy outgo, and the information then at hand may be used for a future

occasion under similar working conditions, and in the same locality, as the basis on which to form other diets. This knowledge of the energy requirements has thus been obtained empirically, and is the result of experience, and the information is more to be depended upon than the knowledge presumed by guessing the amount of work done, expressing it in terms of "light," "medium," or "heavy" work, and allotting to each class an expenditure of a fixed number of foot-tons of energy, and for which an amount of nutrients is supplied according to the class in which the horses are placed.

To guess the quantity of energy expended, and it can never be anything else than a guess, and thereby calculate the daily ration, is to court disaster unless the object in so doing is merely to form a basal diet, subject to such adjustment as may be seen necessary.

For economical reasons it is at times advisable to effect a change in the composition of the diet, and if the present ration provides sufficient energy, and in every way satisfies the tenets of dietetics, it would obviously be foolish to effect a substitution which would materially alter its energy value. It is well known that full advantage is not taken of the economical possibilities of substitutional dieting. This is due to some extent to prejudice, but largely to unsatisfactory results brought about by effecting substitution without paying due regard to the real value of the food-stuffs used.

In order to adjust a faulty ration, or to effect a substitution in one already correct, a clear conception must be held as to the energyvalues of the food-stuffs given to horses. Failure to duly appreciate the energy requirements of horses and the distinctive values of the nutrients used is bound to lead to false adjustment and all that pertains to the error.

That some confusion of thought exists among those responsible for fixing the rations of horses, as to the energy values of foods and their application, is known, and the object here is to attempt to remove this confusion and suggest values for the more common food-stuffs which enter into horses' rations.

In order to make clear what follows, it may not be out of place to discuss briefly the forms of energy and their application.

Every food-stuff contains an amount of latent energy, the total quantity of which can be liberated on combustion and measured in terms of heat if burned in a calorimeter. This is the *energy of combustion* or *chemical energy*. The whole of this heat or energy is not, however, available for body usage, as a certain portion of it is lost owing to the liberation of incompletely oxidised gases, the formation of urea, and as undigested portions in the form of fæces. The chemical energy is therefore described as *potential energy*, since it exists in possibility and not in actuality. The energy in a food-stuff,

less the losses just mentioned, is available for distinctive purposes in the body, hence it is termed *available or metabolisable energy* (1). This total available energy has primarily a call made upon it for the energy expended during the processes of digestion and assimilation; whereby, incidentally, heat is evolved which serves to make good that lost by radiation and evaporation. Whatever energy remains after deducting these losses is *net energy*, and is available in the first place for carrying on the vital functions. Thus, the first call upon a food is for maintenance purposes, for the maintenance of heat and for the maintenance of vital physiological functions. It will be obvious that a food-stuff may have a high combustion value and be able to supply sufficient heat to the body, but, at the same time, it may not yield sufficient net energy to satisfy functional calls; such is the case with wheat straw, and the ultimate end of an animal fed exclusively on such a ration would be death by starvation.

If there is any surplus net energy over that required by the body for maintenance it will be available for productive purposes, such as the formation of fat, the secretion of milk, or for the exhibition of external work, as in hauling a load.

The value of a food for maintenance is reckoned as the heat value of the metabolisable nutrients; its value is essentially thermic, and a ration for maintenance calculated on its thermic value would be efficient provided that it contains a sufficiency of available heat units and enough net energy for functional purposes. Nutrients given for purely productive purposes (dynamic) have a value which depends upon their response to the purpose for which they are given, and will have a lower value than if given for maintenance purposes, since a portion will, in the case of the former, have to be deducted for the energy expended on digestion, but this deducted portion (thermic) may be placed to the credit of the maintenance portion of the ration, from which an equal amount may be removed.

The whole of the net energy given for the purpose of work production is not, however, expressed in full value as visible work, because when increased muscular action takes place, as in drawing a load or in similar work, there is an increase of metabolism, and part of the nutrients given with the idea of them being converted into visible work must go to make good the losses incurred thereby. The percentage of energy expressed as work naturally varies with the character of the work and the conditions under which it is done; but, as a general rule, it is considered that two-thirds is absorbed during the conversion of stored kinetic energy* into visible work.

* The term "potential" is also applied to the stored kinetic energy; thus, of the stored or potential energy only one-third becomes converted into kinetic energy for external work.

For a correct estimation of the nutrient values of food-stuffs it is necessary to express the nutrients in terms of their heat-producing power for maintenance, and in some other term for "production." For the latter purpose the production of bodily increase or the formation of fat is used.

By reducing the digestible nutrients in a food-stuff to a common term, the heat-producing value and the fat-formation value of which are known, it is possible not only to compare one food-stuff with another for either or both of the purposes stated, but it is also possible to estimate how much thermic energy would be available, or how much fat could be formed from any quantity of a food if the digestibility of its nutrients are known for the animal for which the calculations are to be made.

As the result of many years of work, Kellner (2) and his associates have calculated the fat production capabilities of a large number of food-stuffs for oxen and expressed these in terms of digestible starch for fat production. The result of Kellner's work is embodied in what is known as Kellner's Starch Equivalent Theory.

While this theory has lately been criticised and fully discussed by Wood and Yule (3), by Murray (4), and by Halnan (5), it is possible that their writings have not been at the hand of the busy practitioner, therefore it may be convenient to briefly discuss the method of estimating the thermic energy of a food and Kellner's method of ascertaining the starch equivalent of foods for fat production.

It is well known that the amount of heat evolved on combustion of a substance depends upon the amount of oxygen it requires for complete oxidation. Thus fat will yield the most heat, protein less, starch still less, and amides least of all. Thus it has been found that :—

1	part of	starch	requires for	complete	combustion	1·12	parts oxygen.
1	,,	protein	,,	,,	,,	1·77	,, ,,
1	,,	fat	,,	,,	,,	2·9	,, ,,
1	,,	amides	,,	,,	,,	·6	,, ,,

Since, however, all of this potential energy is not convertible into kinetic form, owing to the losses already mentioned, it is considered that the heat value of these nutrients in the body is as follows :

1	part of	starch (digestible carbohydrate and digestible fibre)	1
1	,,	digestible true protein	1·25
1	,,	digestible fat	2·3
1	,,	amides (completely oxidisable)	·6

If, then, the amounts of the nutrients which are digestible in a food are multiplied by their factors they will be reduced to terms of equality and of digestible starch. The sum of the total equalised

nutrients contained in a given weight of the food-stuff can be expressed in comparable terms with an equal weight of starch for heat-producing purposes, *i.e.*, in terms of thermic energy. Furthermore, not only can a given weight of any food-stuff be compared with starch for thermic purposes, but a given weight of one food-stuff can be compared with any other and the two with starch for the same purpose.

Assuming that the digestible nutrients of 100 lb. oats are: True protein, 7 lb.; amides, 2 lb.; fat, 3 lb.; carbohydrate, 44 lb.; and crude fibre, 3 lb., the formula to reduce oats to its thermic or maintenance starch equivalent will be :—

$$(7\times1{\cdot}25)+(2\times0{\cdot}6)+(3\times2{\cdot}3)+(44\times1)+(3\times1)=64.$$

One hundred pounds of this given sample of oats, containing the amount of digestible nutrients as stated, has, therefore, a heat value of 64, compared with a heat value of 100, which is contained in 100 lb. digestible starch. Therefore, 64 is the maintenance starch equivalent of oats.

If, then, we know the heat value in terms of calories, or any other heat unit, of a given weight of digestible starch, we are able to compute the heat value in like terms of a given weight of oats or any other food the digestibility of which is known. Further, if we know the daily loss of heat from a resting animal expressed in the same term of heat unit, we are able to calculate the weight of any food which must be given daily to make up for this wastage. It is therefore possible, with the aid of Rubner's law (6), to estimate the daily thermic energy expressed in terms of M.S.E. which will be required for a horse of any weight.

Production Value.—Kellner (2) found that if pure nutrients were added in a finely divided form to a basal ration they formed fat as follows :—

1 kilogramme of protein	formed	235	grammes of fat.	
1 ,, starch	,,	248	,,	,,
1 ,, fat	,,	474 to 598	grammes of fat.	

Taking starch as unity, the factors to reduce the other nutrients to the same term are :—

True protein	0·94
Starch	1·00
Fat	1·9 to 2·4

The factor 2·4 is used for the fat contained in oilcakes, 2·2 for grains, and 1·9 for the fat in coarse fodder, such as hay and straw, since the value of the fat decreases the more it is surrounded with fibre. On testing the applicability of these factors it was found, in the case of concentrated food, such as cotton seed cake meal, linseed cake meal, etc., that they held true, and the digestible nutrients of the

food-stuffs formed fat to the same amount as if pure nutrients had been given. On the other hand, it was found that with hay and straw there was a considerable decrease in the fat formed from that as calculated; so that, as Kellner points out, if the digestible nutrients of hays, straws, and other coarse foods are reduced to terms of productive starch and the sum of the converted nutrients is credited with its apparent value, a grave error will be committed by giving to these foods a productive value they do not possess; therefore, a deduction must be made from the assumed production starch equivalent in order to bring it to its true level.

Kellner found that the response of a food for production became less as the difficulty of digestion increased; and that the energy expended upon digestion depended upon the amount and character of the fibre present, the depression of the net value being largely due to this cause and to the fact that of those foods the digestion period of which is prolonged, putrefaction to some extent takes the place of true digestion.

In order to express this depression of the net value of foods, Kellner gave to each food-stuff a "value number," which indicates the net percentage available for production over that calculated by the formula. Thus, with concentrated foods containing little crude fibre, such as some oil-cake meals and maize, etc., little energy is expended on digestion processes, and to these are allotted full value, or 100. Oats has the value number of 95, wheat bran 77, and barley straw 46. While the difference between the M.S.E. and the P.S.E. when reckoned according to their respective formulæ is not great (an average of about 3 per cent.), the difference between them when Kellner's "value number" is reckoned on may or may not be considerable. Thus, for oats the calculated M.S.E. is 64, the calculated P.S.E. 60, and the net P.S.E. 58. For maize the calculated M.S.E. is 80, the calculated P.S.E. 77, and the net P.S.E. 77 (full value). Meadow hay has a calculated M.S.E. of 40, a calculated P.S.E. 38, and a net P.S.E. 23. It will therefore be clear that if for the small amount of concentrate (oats or other grain) included in the maintenance ration of horses no great error will be committed if the necessary amount is reckoned on its dynamic value, especially when allowance is made for variation in composition of the cereals and the variability of other dietetic factors. On the other hand, when the valuation of coarse fodders is under consideration a different view must be taken, because the difference between their thermic and dynamic values is great and because hay and straw are fed for maintenance purposes. Therefore their food values will be essentially thermic; and to calculate the amount of hay necessary for maintenance on its lower dynamic

value would mean that some 87 per cent. more hay would be allowed than is required.

The need for a distinction between the thermic and dynamic values of nutrients is fully recognised by animal nutrition experts, and the formula utilised here for calculating the thermic energy is that used by Wood and Yule (3) in their statistical enquiry into the starch equivalent theory. Murray (7) having clearly defined the points at issue, has constructed tables of nutrients and allotted to them their respective thermic and dynamic values.

He has in addition taken certain horse dietaries and furnished from them examples of his method of ration construction. Murray, however, expresses the nutrient values in terms with which those who are most commonly employed in horse dieting may not be familiar, and it is questionable to what extent the busy practitioner will be prepared to change his method of working. Warrington also gives a table (8) showing the maintenance and production starch equivalents of a variety of food-stuffs, but for oxen and sheep only.

Kellner himself clearly emphasised the distinction between the two values, and stated the maintenance ration of oxen in terms of maintenance starch equivalent (the error in his appendix has been pointed out by Halnan) (5); but notwithstanding this he calculated both thermic and dynamic energy requirements of the horse in terms of production starch equivalent, and Woodruff (9) followed his example, and in so doing arrived at an erroneous conclusion as to the amount of nutriment necessary for a horse for maintenance purposes, as will be shown hereafter.

Though Kellner suggested that his production starch equivalents are in a general way applicable to the horse, it is certain that for a large number of food-stuffs, especially coarse fodders, the value as estimated for oxen will be too high for the horse, whose power of digesting coarse foods is considerably less than that of oxen. Therefore it may be supposed that a more correct assessment of both thermic and dynamic values will be obtained if the availability of the nutrients is calculated when allowance is made for lower digestibility co-efficients. The writer has, therefore, appended a list of digestibility co-efficients, by means of which the maintenance and production starch equivalents here suggested have been calculated. Where the digestibility is not known the co-efficients have been assumed from analogy, and the method by which these approximate figures have been obtained is in each instance explained. It is admitted that subsequent investigation may require these to be modified; but it is believed that utilising these assumed figures will give more accurate results, and, in any case, be theoretically more sound than if the digestibility of the

various foods by oxen be taken as in all cases applicable to the horse, which undoubtedly they are not.

The bracketed letters refer to the authority for the figures given. Thus: K=Kellner; H & M=Henry and Morrison; A = Assumed.

Foodstuff.	Digestion Co-efficients. Protein	Fat	Carbohydrate	Crude Fibre.
Oats	80	71	75	29 (K)
Maize	76	61	92	40 (K)
Barley	80	42	87	29*(K)
Beans	86	13	94	65 (K)
Peas	83	7	89	8? (K)
Bran	79	71	71	26 (A)
Dried Grains	71	71	60	26 (A)
Linseed Cake	82	53	96	— (K)
Carrots	99	—	94	— (K)
Meadow Hay (v. good) ..	63	22	65	48 (K)
Meadow Hay (medium) ..	58	18	58	39 (K)
Italian Rye Grass Hay ..	63	22	65	48 (A)
Red Clover Hay ..	56	29	63	37 (K)
Timothy Hay (American)	21	47	47	43(H & M)
Oat Straw	33	12	42	35 (A)

The co-efficients of digestibility of oat straw have been assumed in the following manner. The relation existing between the co-efficients of medium meadow hay for horses and for cattle have been applied to oat straw. Thus it is concluded that, taking the co-efficients of the nutrients as unity in the case of the ox, for the horse they will be: Protein, 1; fat, ·33; carbohydrate, ·9; and crude fibre, ·65. Since the digestion of oats by oxen and by horses has been found to be similar there can be little error in considering that horses will digest bran equally as well as do cattle, and therefore the figures published by Kellner for cattle have been adopted here for the horse. For the digestibility of dried brewers' grains the co-efficients for oxen for the protein and carbohydrates, as shown by Kellner, have been applied to the horse, while those for fat and fibre have been given a lower value and taken to be similar to those of bran. As the percentage composition of Italian rye grass hay (Scotland)† is practically identical with that of very good meadow hay (Kellner), it is considered that the two will be equally digestible.

In order to determine the maintenance and production starch equivalents, the analyses of the various food-stuffs have been taken

* Assumed to be the same as oats.

† For the analysis of Italian rye grass hay, the writer is indebted to Dr. Lauder, of the Edinburgh and East of Scotland College of Agriculture.

from Kellner's list, since these differ little from those published in this country. The digestion co-efficients used are those stated above, and the factors for calculating the respective values are those previously mentioned. Where a more exact estimate of the nutrient value of a food is required, as in feeding experiments, it will, of course, be necessary to calculate the value of each sample on its analysis; but this being impossible in practice, an average valuation must be utilised, and it is believed that the values here given will be sufficiently near for practical purposes. As American Timothy hay figures in two of the rations given in this paper the starch equivalents have been calculated on the analysis of the hay, and the percentage digested as given by Henry and Morrison (10).

Foodstuff.	Starch Equivalents. M.S.E.	P.S.E.
Oats	64	58
Maize	80	77
Barley	69	66
Beans	76	66
Peas	71	63
Bran	59	42*
Dried Grains	60	45
Linseed Cake	75	64
Carrots	10	8
Meadow Hay (v. good)	45	30
Meadow Hay (medium)	40	23
Italian Rye Grass Hay..	45	30
Red Clover Hay ..	41	29
Timothy Hay (American)	39	23
Oat Straw	27	12

The amount of nutriment required by oxen for maintenance purposes has been settled at that which will yield some 10,800 Calories for an ox of 1,000 lb. live weight when calculated on M.S.E. (2), (3), (5). There still, however, seems to be some confusion of ideas as to the amount required by horses. This is largely due to the fact that Kellner expressed the maintenance requirements of horses in terms of his Production Starch Equivalent. He fixed the nutriment required on the result of three series of experiments, in two of which the animals were fed a mixed ration containing a large proportion of foods of a relatively high dynamic value. The rations were working rations containing a small proportion of coarse fodder. In the third experi-

* The opinion once held by many veterinary practitioners that wheat bran has little or no nutritive value can no longer be considered true, as there is abundant proof, both experimental and practical, that it has at least the P.S.E. here given.

ment of the series the diet was composed of meadow hay "in which in some cases straw and corn were added." He found in series (1) that 3254 g. of starch equivalent satisfied the maintenance requirements of 500 kilogramme horses; in series (2), 3364 g., and in the third series, where the rations consisted chiefly of coarse fodders, 3312 g., and he concludes that for 500 kg. horses 3·3 kg. of starch equivalent is required for maintenance purposes.

It is important here to note that Kellner meant "production starch equivalent" and, furthermore, production starch equivalent calculated for ruminants, It will be plain, when the rations here given are examined, that Kellner estimated the maintenance requirements on P.S.E. When estimating total rations for working purposes Kellner adds this 3·3 kg. to the amount of P.S.E. reckoned for work and expresses the whole as "starch equivalent," meaning P.S.E.

It will be profitable to examine closely the second and third series of Kellner's experiments (the first is similar to the second). The average weight of the horses in the second series was 953 lb. and they were fed the following ration :—

				P.S.E. (K)
·94 kg.	Hay	or 2·07 lb.	forming	·64
·51 ,,	Straw (oat ?)	,, 1·12 ,,	,,	·19
1·77 ,,	Oats	,, 3·90 ,,	,,	2·34
·38 ,,	Beans	,, ·84 ,,	,,	·56
1·31 ,,	Maize	,, 2·88 ,,	,,	2·36
·26 ,,	Maize Cake	,, ·57 ,,	,,	·42

Giving a total starch equivalent of .. 6·51 lb.
which is equal to .. .. 11,132 Calories.

For a horse weighing 1,000 lb. this will be :—

$$6{\cdot}51 \times \sqrt[3]{\left(\frac{1000}{953}\right)^2} = 6{\cdot}73 \text{ lb. P.S.E.(K) or } 11{,}500 \text{ Calories.}$$

In the third series the ration is not stated, except that we are told that meadow hay was given along with, in some cases, straw and corn; Kellner also found in this series that 3·3 kg. of starch equivalent satisfied the requirements of 500 kg. horses. In his third test the rations were similar to those given in the other series, in so far as 3·3 kg. of P.S.E. were allowed per 500 kg. live weight and that the amount of nutriment satisfied the animals' demands. On the other hand, the diets were widely different, as they were composed chiefly of coarse fodders, and, though they yielded the same amount of dynamic energy expressed as production starch equivalent, it will be presently shown that for maintenance purposes there was a much larger quantity of available energy. Not being able to ascertain

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the exact rations which Kellner used during his third test, we must compound one similar to his, and one which will give an identical production starch equivalent for horses weighing 953 lb.; such ration would be :—

		P.S.E. (K)
Meadow hay (good)	10 lb. forming	3·1 lb.
Oat straw	6 ,, ,,	1·0 ,,
Oats	4 ,, ,,	2·4 ,,
Total		6·5 lb. P.S.E.
Or		11,115 Calories.

We have here two rations each of the same production starch equivalent and consequently each of the same calorific value when this is reckoned on the P.S.E. But the dynamic value of a ration is no true guide of its maintenance worth unless the ration is composed almost exclusively of food-stuffs having a relatively high dynamic value. If they are formed, as they usually are, mainly of coarse fodders the real maintenance value will be much higher than one would be led to suppose. This will be made clear if we reduce the two rations to their maintenance or thermic value and express them both in terms of maintenance starch equivalent, as follows :—

		M.S.E.	
Hay	2·07 lb. forming	·83 lb.	
Oat straw	1·12 ,, ,,	·30 ,,	
Oats	3·90 ,, ,,	2·50 ,,	
Beans	·84 ,, ,,	·63 ,,	
Maize	2·88 ,, ,,	2·30 ,,	
Maize cake ..	·57 ,, ,,	·43 ,,	(M.S.E. 76 assumed)
Total		6·99 lb. M.S.E.	
Or		11,970 Calories.	

The second ration will then be :—

		M.S.E.
Hay	10 lb. forming	4·0 lb.
Oat straw	6 ,, ,,	1·6 ,,
Oats	4 ,, ,,	2·56 ,,
Total		8·16 lb. M.S.E.
Or		13,954 Calories.

If this ration had been composed entirely of meadow hay, as some of the rations in Kellner's third series were, a still larger quantity of fodder will have to have been given in order to put it on a level with the ration of the second series so far as production starch value

is concerned, and in consequence, instead of there being a difference of 2,000 Calories it will be still larger. It is difficult to see how Kellner obtained almost identical returns from two rations fed for maintenance purposes and having a thermic value difference of at least 2,000 Calories.

In 1912 Harold Woodruff (not Hiram Woodruff) published (9) a small manual on the feeding of horses for the guidance of horse owners, veterinary surgeons and students, and in it he refers to the estimates for maintenance given by well-known authorities, and reviews, in some detail, the work of Kellner. He takes as his standard maintenance requirements " an amount of food providing the equivalent of 6½ to 7 lb. of digestible starch " for a 1,000-lb. horse, meaning thereby production starch equivalent according to Kellner's theory. Woodruff then gives four rations calculated for the maintenance of 1,000-lb. horses and reckoned on a starch equivalent, but not Kellner's starch equivalent, for he makes use of an empirical factor in place of Kellner's " value number." It is true that the error in so doing is not great with the majority of foods, but it is considerable with such foods as bran and dried grains, to which Kellner ascribes a comparatively low value number. Of the four rations given, two may be examined in detail and reduced to their thermic and dynamic values.

No. 2—		M.S.E.	P.S.E.	P.S.E. (Woodruff.)
Hay (v. good)	10 lb. forming	4·5	or 3·0	or 3·21
Oat straw ..	5 ,, ,,	1·4	·6	·53
Oats ..	6 ,, ,,	3·8	3·5	3·6
Total ..	..	9·7	7·1	7·34 lb.
Or ..	..	16,587C.	12,141C.	12,551C.

No. 3—		M.S.E.	P.S.E.	P.S.E. (Woodruff.)
Hay (v. good)	10 lb. forming	4·5	or 3·0	or 3·21 lb.
Oat straw ..	5 ,, ,,	1·4	·6	·53
Maize ..	2 ,, ,,	1·6	1·5	1·61
Oats ..	3 ,, ,,	1·9	1·7	1·8
Total ..	..	9·4	6·8	7·15 lb.
Or ..	..	16,071C.	11,628C.	12,226C.

From the above examination of Woodruff's rations it will be obvious that though he intended his suggested diets to have a maintenance value similar to the value prescribed by Kellner, he really failed to do so, and allows for a 1,000 lb. horse an amount of nutriment far in excess of what Kellner thought to be requisite.

Having pointed out that a greater amount of nutriment is required for the maintenance of horses than for cattle, owing to the more

restless nature of horses and to the fact that they require at least a modicum of exercise, Jordan (11) reviews the estimates of Zuntz, Grandeau and Wolff, and concludes that 6·6 lb. of digestible organic matter is required daily for a resting horse of 1,000 lb. He gives eight rations which he says will meet the requirements. Of these, Nos. 2 and 3 are utilised here for discussion :—

			M.S.E.		P.S.E.
(2) Timothy hay ..	10 lb.	forming	3·9	or	2·3 lb.
Oats	5 ,,	,,	3·2		2·9
Total			7·1		5·2 lb.
.. .. ..			12,141C.		8,892C.
			M.S.E.		P.S.E.
(3) Timothy hay ..	10 lb.	forming	3·9	or	2·3
Maize ..	4 ,,	,,	3·2		3·0
Total			7·1		5·3 lb.
Or			12,141C.		9,063C.

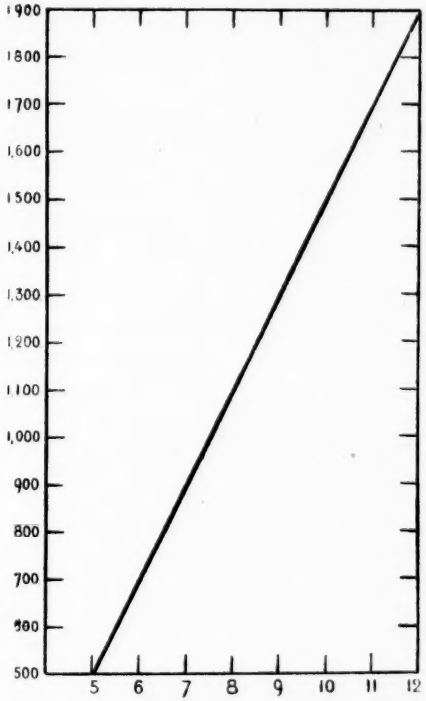
The thermic energy in Jordan's rations is, therefore, similar to the amount which Woodruff apparently thought he was prescribing.

Murray (7) holds that the energy maintenance requirements of the horse are the same as those of the cow for equal weights, but we know that horses require an additional amount for reasons already stated. Even so, Murray's estimate must be considered too high. His allowance is 35 kilo-pound-units, which is equivalent to 15,890 Calories. He apportions the maintenance ration of a 1,000 lb. horse as follows : ·75 lb. protein and 8·3 lb. "starch." This corresponds to 15,683 Calories when the whole is reckoned as digestible starch.

Armsby (12) allows about 21 per cent. more energy for maintenance for horses than for cattle, so that, if we take Wood and Yule's estimate of 10,840 Calories M.S.E. for cattle, the allowance for a 1,000 lb. resting horse will be 13,116 Calories M.S.E. Finally, Warrington (8), referring to Zuntz, says that a horse of 1,100 lb. will require food supplying 12,000 Calories per day, equivalent to about 7 lb. of "digestible starch," and suggests as a ration which will meet these requirements, 10 lb. straw chaff (oat ?) and 6¾ lb. maize. This ration can be expressed as follows :—

			M.S.E.		P.S.E.		P.S.E. (Kellner.)
Oat straw ..	10 lb.	forming	2·7	or	1·2	or	1·7 lb.
Maize ..	6·66	,,	5·3		5·12		5·43
Total ..			8·0		6·32		7·13 lb.
Or			13,680C.		10,807C.		12,192C.

From a perusal of the foregoing one may conclude that the maintenance requirements of a horse of 1,000 lb. weight is approximately 13,000 Calories or 7·6 lb. maintenance starch equivalents, and that Woodruff's allowance of over 16,000 Calories is excessive. The accompanying graph shows the maintenance starch equivalent, calculated by surface law, for horses of various weights; it is so nearly a straight line that for practical purposes it may be regarded



as such. The thermic energy here suggested for maintenance should be sufficient for stabled horses or for working horses when the dynamic portion of the ration is adequate. To what extent it would be suitable for horses doing slow delivery work, with much standing, in towns in the winter months it is difficult to say. It will certainly not apply to horses under treatment for parasitic skin disease, where the loss of heat from the skin is materially increased by the application of varnish-like dressings. Neither will it be adequate for horses picketed in the open during a winter campaign.

To calculate a maintenance diet on production starch equivalent,

whether or not the maintenance requirements are expressed in terms of the same value, is misleading. With hard-working horses, where the coarse fodder is reduced to the optimum minimum, and the percentage difference between the thermic and dynamic values of the whole ration is small, the probable error will not be large. But where the maintenance ration consists chiefly of coarse fodder, a considerable over-estimation will be the result, and the animal will be given more food than is necessary. Furthermore, a diet would be prescribed which would not be given in practice; and farmers and horse-keepers, with an inclination to feed according to scientific teaching, would put on one side the starch equivalent theory; not only, as some do, because of its complexity, but also because it would not be found to tally with practical experience.

There is another serious drawback to estimating maintenance rations in terms of dynamic value. Having clearly defined to the student the distinctive values of both the thermic and dynamic energy obtainable from a food-stuff, it is inconsistent to utterly ignore the thermic portion when compounding a ration for either maintenance or working purposes.

Murray (4) objects to applying the term "Starch Equivalent" as used by Wood and Yule (3) for an essentially thermic ration, and says that confusion must result if the term "Starch Equivalent" be applied to essentially different things. We would, however, point out that no confusion can be worse than that which exists when production starch equivalent is used as by Woodruff; and that, as Halnan (5) has stated, the position is at once made clear when the two starch equivalents are calculated each on its own value. As he says, once it is realised that Kellner's starch equivalent means starch equivalent for production "there will exist no longer any danger of the student or scientific worker using the 'starch equivalent for production' of a food to express the 'maintenance starch equivalent.'"

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REMARKS ON THE ECRASEUR IN PRACTICE.

By T. M. Inglis, J.P., M.R.C.V.S.
Forfar.

I noticed in the reports of the meeting of the North of Scotland Veterinary Society, held on August 26th, 1916, that some very interesting subjects were introduced for discussion.

One of these, the castration of colts, never fails to create interest at meetings in Scotland, and the practitioner does not exist who has not had some little reverse in his success with the operation.

Each practitioner has his own opinion as to the best method and instrument to use; he operates to have the best possible results, and naturally he adopts the mode he has found to be a success. Why should he practice any other method—unless he is of a progressive nature, and wishes to improve upon an old-fashioned system? I have no doubt many still use the cautery and caustic clamp, and if the colts do well, and they hear no complaints, I see no reason why the method should be changed, unless that both methods are easily adopted by the gelder, are troublesome, and do not look scientific. The heating of the irons is not always easily accomplished; the clamp method has its drawbacks in the removal of the instrument—this is best done by the practitioner, who cannot always find time to pay a second visit. When it is left to the owner or blacksmith, one is never sure of two things—sepsis, and adhesions.

I find the écraseur the favourite instrument amongst Scotch practitioners, and at the meeting referred to, if my memory serves me right, the discussion on mode of castration bears this out.

I was trained as a pupil to operating with the actual cautery but never liked its use; then when I took up practice here the caustic clamp was the method relied upon by most practitioners and clients. Many years ago I abandoned the clamp for the écraseur, and amidst a good deal of opposition succeeded in establishing the general use of the instrument.

I had no experience of the écraseur previous to that, and had a good deal to learn as years went on. I have now every confidence in it, and would never employ any other. Experience has taught me the better use of the instrument, how to keep it in good working order, and many little details which one finds essential if its use is to be a success.

First of all, the usual instrument is made too slender. I have had many instruments giving way at the anxious moment. These weak parts I have had strengthened in a specially made instrument.

The chain, always a source of worry, is often too fine, the link too firmly riveted—each link ought to have free movement. The chain

itself ought to have a sharp and a blunt side ; that is, the sharp edge should be filed off at the sides of the links on the one side. This blunt side I always use when castrating.

There is a difference of opinion about the slot in the instrument where the chain passes through. My own opinion is that the chain ought not to fit too tightly—every link should pass through freely. If it is tight it is more likely to cut instead of crush, especially if the edges of the slot are kept as sharp as the maker would like one to use it.

I know I have had less trouble from hæmorrhage since I saw to the easy movement of the chain links, and that the slot did not grip the chain too tight. I found this out when using an old " Farmer Miles " instrument with a fine chain, and extra large easy slot. When using this instrument I had no hæmorrhage, but one day a neighbouring practitioner who happened to witness its use advised me to get a new instrument—pointing out the large slot as a danger ; and being much younger and less experienced than my neighbour I took his advice, and had no end of trouble with the new instrument. I therefore made use of the older one, and once more I got peace in mind when operating. For a time I could not make out the difference, but later had the slot of the new instrument made easier, and the edge blunted, and together with a blunt side on the chain I had no further trouble, and have seen to this since.

During the season it sometimes happens that some days a number of colts will bleed one after the other, then the cases of hæmorrhage will suddenly cease. This appears without any apparent cause, but I am always inclined to believe it is due to one or more links becoming stiff in the chain ; hence the necessity of seeing to the chain being easy in its movement.

The écraseur is a very useful instrument in removing the testicles of the cryptorchid class of colts ; especially when one encounters a short cord, the instrument can be introduced into the canal or even abdomen, as is the case in the double ridgling, when, if one fails to get both from one wound, it often occurs that the near side testicle has been taken from the off side, and *vice versa*.

Last autumn I had presented to me a double schirrous cord for operation, and anyone who has experienced their removal with the écraseur knows the great risk one runs in the chain giving way. I adopted a new plan to avoid this, and removed both quite easily.

I may state, at the commencement of the operation one chain gave way on very little stress, and when I had another put on, with its sharp side to the tissue, I screwed it up quite tight, as tight as I thought was safe, then, with an assistant holding the tumour, I turned the whole instrument round twice or three times, which must have torn a

considerable amount of the tissue, because I was thus enabled to give the screw a few more turns until I found it too tight again. Then the instrument was turned again as before, and the process repeated with comparative ease.

Degive recommends passing a metal rod through the swelling after the écraseur has almost cut through the spermatic cord, turning that part of the cord within the chain once or twice around its long axis, and then completing the operation—this he terms "tortion bornée."

When I meet with an extra long strong cord in an abdominal testicle I usually turn it on its axis several times before applying the chain, and with good results.

The instrument and chain ought to be attended to immediately one returns home, or sooner if at all possible, after the day's work. We always wash with soap, boiling water, and a little antiseptic in the water, then boil in a steriliser, dry with a prepared towel, then when warm apply a good dressing with antiseptic vaseline, making sure to work the links of the chain well with the dressing.

Some, I understand, "smoke" the chain by passing it several times through a flame—this may keep the chain, but the heat is likely to alter the links, and the chain to my mind is always too dry.

It is astonishing how careless some are with the place an écraseur is kept in after being sterilised. I have witnessed an instrument washed in a horse-trough after use at one place, and another animal to do in the neighbourhood, and without any further treatment—strange to say no bad results followed.

I once had occasion to be operating on a five-year old single cryptorchid, and the practitioner who employed me stated I would not require my écraseur, because he had a good one, and had had it thoroughly sterilised that morning. When it was presented to me I found it wrapped in the cloth that had been used all season, and a fine sight it was. I need scarcely state I made some excuse for not using this very good instrument of the newest pattern. When operating, especially with the écraseur, experience has taught the older practitioners not only to provide the necessary instruments for the operation, but also those necessary for any accident that may happen during its progress. It may be asked how is one to know anything will happen and what to be provided with.

It is always the most unlooked for thing that happens. Some years ago I was asked to operate on a two-year old with an abnormally large testicle on one side. I opened the sac, and found a large quantity of serum, and in the centre of it, to my astonishment, I found the urinary bladder, which I could trace right up to the pelvic cavity. Before I discovered the kind of abnormality presented I considered

it to be a cystic testicle, but on tapping it with a trocar the contents proved to be urine, which accounted for a flow of the same from the penis when handling that organ.

I broke down all adhesions, and got the bladder within the cavity, but, having a very long neck, it found its way back into its former position in a day or two. This animal gradually began to exhibit symptoms of danger, and it was obvious he would not recover. Mortification of the bladder had set in, and we destroyed him.

Another subject two years old, with a report that one testicle could easily be felt, but the other only occasionally. Thinking the case one of a single inguinal cryptorchid I had no hesitation in putting him on his back, and proceeded to get the retained testicle down into the scrotum, which I was certain I could feel in the canal. After pulling well on what I thought was a fairly well-developed testicle, and tightening the skin over it, I made a bold incision, and to my surprise a shower of blood went all over me. I kept a good grip with my left hand, and directed someone to hand me from my bag at my right two " Spencer Wells " forceps. These I applied to the mouth of the wound, and as far up as possible ; then I had applied round both, and tied as tight as possible, a firm suture of rea fibre, and chanced leaving my hold of the part. The scrotum filled up quite tight, and I was rather anxious about the purse-string suture holding, but it kept its grip, and the animal was allowed to rise : the result was a good recovery, and I removed from the same side next season an abdominal testicle.

What I injured must be obvious to all, but the vessel must have been of a varicose nature and abnormally large. Had I not kept a firm grip with the left hand, which must have included a portion of the injured vessel, hæmorrhage would have been very difficult to arrest. It was also lucky I was provided with the instruments I used, and quite close to my right hand, otherwise I should have had a good deal of trouble. I always have with me a good supply of instruments and dressings when operating, and am sometimes asked what I require all these for, and I am only able to say " for what might happen." One has to adapt one's mind to circumstances which might be presented without any warning, and I once remember being asked by a neighbour to consult with him as to what ought to be done with a case of ventral hernia in a foal, the result of a kick from a horse. There was no external wound, but the muscles were ruptured and a wound about 6 ins. in length, and about 6 ins. below the point of the ilium. The injury had happened some hours before my arrival, and I found the bowels had worked their way out of the wound, and down beneath the skin as far as the umbilicus. We made an incision over the site of the wound, and by careful manipulation got the bowels returned within

the abdominal cavity. The internal wound now presented itself, and was very difficult to suture; the gut suture had to be of the thickest kind; otherwise when pulling the wound together the muscles came into action and the edges were likely to give way. We found a good deal of this gut was required, and at a glance we saw that our quantity was not sufficient. Being at our wits' end to know what to use, my neighbour suddenly exclaimed, whilst holding the wound, "What about clock gut?" and finding the owner had in his possession an old-fashioned clock it was suggested he at once remove one of the weights, and bring the gut. This was done, and we soaked the gut (which was anything but aseptic) in crude Jeye's fluid, then washed in clean warm water. Being faced with a failure if we delayed we risked using the gut, and a very suitable suture it made; so much stress being necessary to bring the parts together. The outer wound was tied in sections and very tight, similar to the method employed in the treatment of umbilical hernia. This case made an excellent recovery, and after the outer portion sloughed the part had almost healed. During the progress of recovery a serous abscess formed near the umbilicus, where the bowels had been. This was punctured with success.

These cases have all been recorded before, but I thought they would be useful when emphasising the necessity of being provided with more material and instruments than usually required at any operation.

I have no experience with any other instrument for castration than the écraseur, but have no doubt the others have been well tried and relied upon, but I have often seen instruments of different patterns in the instrument cases which have never been in use. The best instrument for the castration of bulls is undoubtedly the Italian instrument introduced first to the profession in this country by Mr. John Brown, F.R.C.V.S., of Invergordon. I first witnessed its use by my friend in 1913, and was somewhat shy in adopting it, but would never think of any other method now. It has many important advantages and one disadvantage which at times may be troublesome.

No wound is made in the skin. It matters little what you have been doing with your hands prior to operating, which is always a source of worry; the animals can be kept almost anywhere afterwards.

Although the cord is crushed, and the nerve supply to the testicle destroyed, it sometimes takes a few weeks for the testicle to disappear, and if the animal is exposed for sale too soon afterwards it may be thought by those inexperienced in the method that the animal has not been castrated. The owner, however, can always give a guarantee that the animal has been castrated, and will not leave stock.

"TIPS" ON CAMELS, FOR VETERINARY SURGEONS ON ACTIVE SERVICE.

(*Continued from page* 89.)

By A. S. LEESE, M.R.C.V.S.

The infective diseases of the camel, other than trypanosomiasis, are collectively of far less importance than the disease named.

The camel is subject, under natural conditions, to anthrax, variola, tuberculosis, rabies, tetanus, botriomycosis, contagious microsis of the skin, and to a pleurisy and pericarditis caused apparently by an organism of the fowl-cholera type. "Influenza" is said to be a disease of camels by some observers; I must say that I know nothing about it, but I think the pneumonia of camels from four to six years of age is possibly a contagious one. There is also an unimportant catarrh in camels, which may be contagious. The anthrax-like disease seen in Indian camels and characterised by swelling about the throat is, I think, anthrax itself, but the blood does not always contain bacilli to be demonstrated; this is true of pig anthrax, too. Anthrax is found in camels in Somaliland and in Jubaland under the name of "Kud," and some forms of it precisely resemble these throat cases of India.

Camels do not suffer from either rinderpest or foot-and-mouth disease under natural conditions. Lingard claims to have caused a mild form of rinderpest in camels by inoculation; and I have tried to infect camels in various ways with foot-and-mouth, but with no success. The fact is that, in countries reeking with these diseases in cattle, the camels do not get them. Laboratory experiments mean little in the face of these facts. On several occasions outbreaks have been mentioned in reports, but they do not bear investigation. Glanders and strangles are not met with in camels. I believe it has been proved that the Bactrian camel can carry the bacterium of plagues.

Anthrax in camels takes a somewhat similar form as in horse and pig, with painful swellings about throat, base of neck, or body. Some of the throat cases, I feel sure, are local inoculated anthrax, probably *via* the punctures made by bots in the naso-pharynx; the swelling is sometimes enormous when the palatal expansion becomes involved. Certainly death may occur without septicæmia, and I have seen, and possess a photograph of, a case exactly resembling clinically that form of the disease which no one seems to see in Europe nowadays, described in text-books as "gloss-anthrax"; the camel was unable to close his mouth or eat owing to the size of his tongue; only one camel out of the three involved in the outbreak had this form, and he recovered from the "gloss-anthrax" but never regained his condition, and his tongue atrophied. As a good many cases do recover, a camel with anthrax should be given the chance.

It is interesting to note that the Somalis, by sheer tribal experience handed down from one generation to another, deal with anthrax as follows: The camel is kept in a small zariba by himself until he is dead, and then a huge thorn-bush defence is built over his body so that hyaenas and vultures cannot get at him until he is putrid.

Variola, or *Camel-pox*, is ordinarily a disease of young camels, usually very benign; in fact, most of them go through it like children and the measles. Adults sometimes get it, and I have seen in working camels outbreaks involving over twenty head in every case; but as a rule only a small percentage of a herd of adults exposed to contagion get the disease. In benign cases, lesions are confined to the lips. A malignant form, however, is sometimes met with, the lesions spreading over the head and, indeed, anywhere on the body, particularly where the skin is thin. Sometimes an eye is lost; and camel-pox is occasionally fatal. The course is about three weeks, and the treatment of benign cases is handfeeding, or grazing only on plants free from thorns, and a daily application of boric vaseline to the lips. If the lips in this disease are allowed to get torn by thorns they swell enormously. A fact of practical importance in this disease is that it is liable to lose its benign character in the rainy season. Young camels are sometimes inoculated by their owners so as to get them through it before the rains. The malignant form seen in the rains sometimes finishes up in pyæmia.

Tuberculosis.—This disease is comparatively rare in India, but not uncommon in old camels at Cairo (Mason). It is not likely to be diagnosed very early, as trypanosomiasis will usually be suspected at first. Emaciation, irregular temperature and appetite are the chief indications. Cross has noticed persistent hæmaturia in one case. Tuberculosis of the camel is usually pulmonary, occasionally generalised. It is chiefly a disease of old camels.

Rabies.—Not infrequently met with in Asia in camels. Camels are peculiarly exposed to attack by rabid wild animals. Sometimes the affected camel is violently aggressive, and a rabid camel is then so dangerous that it is extremely important to see that any camel bitten by a rabid animal is *secured* during the necessary observation period. Some rabid camels are not aggressive, but noisy and terror-stricken, and I have seen a paralysis of the tongue in one case. The chief things for the veterinarian to do is (i) to see that any suspected camel is *secured* so that he can do no damage before a diagnosis is made; (ii) to distinguish it from "mad staggers," a disease caused by indigestion, and in which all the movements are without purpose.

Tetanus is not common, but does occur occasionally as a result of infection through bites or sores; no doubt, also, through shell-wounds. Only a minority recover. The disease sometimes prevents the camel from folding himself up in his usual sitting attitude.

Contagious Necrosis of the Skin.—This is met with in all camel-countries. It is inoculable; and, indeed, many of the lesions in affected camels are due to auto-inoculation—viz., rubbing a diseased surface of skin against a healthy one; thus, a camel with a lesion on his withers may inoculate himself on the poll by rubbing his withers with his poll; and a lesion behind the thigh frequently inoculates the skin over the gastrocnemius region, where they come in contact when sitting. Again, new lesions are apt to form wherever the discharge from current lesions runs down. The new pus from a lesion often appears to be an almost pure culture of streptococci; one may strongly suspect the presence of the bacillus of necrosis, but that remains to be proved. The skin only is involved in the necrosis. The lesions may be of any size, from that of a threepenny bit to that of the palm of the hand. At first there is a diffuse swelling, hot and painful; then the centre gets hard, dry, and black, the hair falling out. Gradually a line of demarcation forms around this hard, black centre, and then pressure on the latter will cause pus to break through in some part of the line. Later, the centre sloughs out like a "sitfast." In favourable cases the wound left heals without trouble; but sometimes there is a great tendency for the edge of the ulcer to become involved in the necrotic process, becoming, in its turn, hard, dry, and black; when this happens, the case is apt to prove rather troublesome. The lesions may occur on any part of the body; but they are rare where the skin is thin, and are seldom seen below knee or hock. Some camels have only one or two lesions, and then the constitutional disturbance is almost *nil*. Others have many lesions, and I have seen deaths from exhaustion, and also from pyæmia, due to them. On the whole it is not a severe disease, however, if the camel is in good condition to start with. Some camels when in poor condition seem to be unable to put up any resistance against the spread of the necrotic process. The disease when it occurs is a great nuisance; and sometimes a sore back becomes infected, and a huge slough results, which may lay the camel up for months.

In the treatment, when possible, affected camels should not only be segregated from the healthy, but also be isolated from one another at a distance of at least six yards. Dressers must have it impressed upon them that the pus in these cases can be inoculated, by the mere rubbing process they often so delight in, into the skin, and that the disease is spread this way. The discharge must be washed off the skin with carbolic soap, without any scrubbing; and all bits of tow used should be burnt or disposed of in a special bucket of disinfectant carried round by the dresser, and used for nothing else but their reception. The dresser should frequently wash and disinfect his hands and instruments, especially when going from one case to another.

The treatment may usefully begin with the administration of 1½ or 2 lb. mag. sulph. if there are more than, say, four lesions.

Local treatment depends on the stage at which the veterinary surgeon first sees his case. If no line of demarcation and separation can be made out, the best treatment I have found to be the painting on of pure carbolic acid around and over the lesion; this may be done on three days running, but generally not more. It has undoubtedly the effect of stopping the outward (centrifugal) spread of the necrotic process, and attains the chief object of local treatment—*i.e.*, to cause the necrotic centre to be sloughed more quickly and neatly than if left alone. As soon as pus can be squeezed through the line of demarcation, one of the branches of a pair of strong dressing-forceps should be passed through the ruptured spot and under the black centre of the lesion; the latter can then be grasped by closing the forceps, and can often be separated quite easily; very often the necrotic piece of skin is removed in this way like a button. Experience has taught me that tearing makes a far better job than cutting; because the knife itself is apt to reinoculate the living tissues. If the dead piece cannot at once be completely separated, the best thing to do is to make drainage for the pus underneath it, and then carefully remove the pus; smear boric vaseline over the healthy skin below it, so as to prevent new lesions being formed there by the discharge; and paint carbolic acid (pure) over the part of the edge of the living tissue where the separation has not been completed. Usually, discharge of pus practically ceases when the necrosed piece is removed; up to that time the veterinary surgeon himself should superintend or do the dressing; afterwards, all that is necessary is a little dry dressing. When the edge of the ulcer shows signs of necrosis (becoming dry, hard, and black), the edge must, in its turn, be treated on the same principles as with the original lesion.

Hæmorrhagic Septicæmia (?).—Under this provisional heading I place a (practically) unimportant condition that I have met with twice, viz., an inflammation of the serous membranes of the thorax, in which the clear exudate was found to be an almost pure culture of bacteria of the fowl-cholera type. Both camels were suffering from trypanosomiasis (Indian surra) as well, and were living with other camels which remained free of hæmorrhagic septicæmia. The cases were in separate herds. Hæmorrhagic septicæmia, chiefly, in India, affects water-buffaloes and cattle, and occurs in country subject to flooding, and at about the same season as Indian surra. Gaiger, in the course of an investigation of hæmorrhagic septicæmia, found that a camel could be inoculated with the bacterium and show no symptoms of disease; yet the bacterium could be isolated from his tissues if the

camel is killed a long time afterwards. It seems that the occurrence of my two cases may be explained in this way, that the camels each became infected at about the same time both by the trypanosome of surra and by the hæmorrhagic septicæmia bacterium; and that the latter had no effect upon the camels until they were sufficiently debilitated from the surra. There is no reason to suspect that hæmorrhagic septicæmia can ever occur as an outbreak in a number of camels.

Pneumonia.—I have found by experience that it is best to segregate cases of pneumonia, especially those occurring in camels of 4, 5 and 6 years old, and I suspect that it is contagious to camels about that age.

Infectious Catarrh.—Usually quite benign, and veterinary surgeons require no hints as to treatment. The clear discharge which is sometimes associated with the exit of camel-bots from the naso-pharynx in spring and autumn must not be mistaken for it.

Botriomycosis is occasionally seen in camels in the form of a complication of sore-back. I have seen it in India, and it has been reported from the Sudan. When complicating sore-backs, removal of the tumour is necessary; otherwise treatment is as for horses.

(*To be continued.*)

Abstract.

ANÆSTHETICS.

By H. D. BERGMAN, *Iowa.*

It is a satisfaction to note that the use of both local and general anæsthetics is coming into much more general practice by the veterinary profession. While it is to be admitted that inadequate facilities often seem to make the use of general anæsthetics inadvisable, yet very frequently the difficulty and danger are both overestimated by the average veterinarian, but from a humane standpoint, and that of satisfactory operating, there can be no argument against. Chloroform is, of course, the most satisfactory general anæsthetic for the larger animals, and it is surprising what results may be derived from a very small amount if properly administered. A dozen anæsthesia sheets taken at random from our College Hospital Clinic reports show that on equines the time taken to establish anæsthesia was fifteen minutes, duration of anæsthesia varied from twenty to thirty minutes, and amount of chloroform used averaged less than 4 ozs., the drop method of administration being used.

Our method with dogs is to administer from one to two grains of morphine hypodermically about twenty minutes before the operation. A few inhalations of chloroform will then put the animal into a nic state of anæsthesia. The period of recovery is usually from four to five hours.

Of late we have been making use of rectal injections of chloral

hydrate in hogs, sometimes followed by a few inhalations of chloroform, but more often not. The dosage of chloral is about 1½ to 2 drams per 50 lb. weight. The chloral, on account of its irritant properties, should be well masked, dissolved, for instance, in 4 ozs. of some fixed oil or glycerine. While this does not give a complete anæsthesia, yet the results are very satisfactory. Twenty to thirty minutes should elapse before operating following the administration of the chloral hydrate.

As to local anæsthetics, cocaine, stovaine, and alypin seem to fulfil the majority of indications in veterinary medicine. For the past year or so alypin has been used largely as a local anæsthetic at the College Hospital Clinic. It seems to possess all the advantages of cocaine without the disadvantages. It is generally used in 5 per cent. solution in regional surgery, the action being noted in about five minutes and continuing equally as long as cocaine. It may be combined with adrenalin solution very advantageously. No symptoms of intoxication, painful after effects, or necrosis of the skin at the seat of injection have been noticed following its use.—*Journal of American Veterinary Medical Association.*

Reviews.

SHEEP DISEASES, by E. T. Baker, D.V.M., pages 228, illustrated. American Journal of Veterinary Medicine, Chicago, 1916. Price 2 dollars 50 cents.

This is the 12th volume of the Veterinary Medicine Series, edited by D. M. Campbell. It is a useful book for the veterinarian and stock-owner, well illustrated and concisely written. It is a text-book dealing more with sheep on big ranges than with ovines kept chiefly confined and folded as they are in this country. Any ailment of sheep can, however, be readily referred to, and knowledge of the condition, symptoms, and treatment can be gathered from the text. The field of disease surveyed is a very comprehensive one, but louping ill or trembling and trotting diseases are almost unknown in America. The best chapter in the book is that on poisons, and the illustration of some of the plants poisonous to sheep are beautifully done. In the chapter on parasitic diseases we notice no reference to *tricocephalus affinis*, which causes much trouble among sheep in certain districts here. The author, to our mind, is very pessimistic as to the treatment of some sheep complaints. The surgical operation for " gid " is not mentioned ; treatment for fluke is said to be hopeless. Piroplasmosis is stated not to exist in America, but we are of opinion that cases occur in sheep in many countries where the disease is neither recognised not diagnosed.

No instructions are given as to how to castrate a ram. We have done many successfully with steel clams with graduated screws, and we believe it to be the best way to avoid fatalities in this animal. All veterinary surgeons who castrate lambs may advantageously note the method given by the author in these words : " Select a clean dry

place for this work (the lambs being about two weeks old), and with disinfected hands and knife hold the lamb, *and cut off the lower third of the scrotum* (the italics are ours). Pull the testicle and entire cord out. In older lambs the cord may be scraped off."

A very interesting chapter in the book, which, fortunately, does not apply to us here, is that on "Predatory Animals." We learn from it that the coyote, the wild cat and lynx, the wolf and cougar, the bear and the prairie dog, all make raids on sheep. Truly the life of a shepherd in some parts of the great American continent must be full of adventure and incident, and not of such a ruminating peaceful, nature as in this country.—G. M.

VETERINARY REVIEW, February, 1917. Edited by O. Charnock Bradley, M.D., D.Sc., M.R.C.V.S., Principal R.V.C., Edinburgh. Issued quarterly; annual subscription, 10s. 6d., post free; single copies, 3s. 6d. Published by W. Green & Son, Ltd., London and Edinburgh.

This, the first number of a new periodical, gives an account of current literature of interest to the veterinary specialist and practitioner. Its contents consist of an article on "Feeding and Economy," by Professor R. G. Linton, M.R.C.V.S.; abstracts, reports, reviews, notes on books, and bibliography. As a quarterly recording the appearance of current veterinary pabulum, and giving the pith of matter printed in America, France, and our Colonies, it will be found useful and time-saving to the practitioner who wants to refer quickly to any subject without reading deeply on it, or who desires to know where he can obtain further information on matter interesting to him.

To the author and compiler of veterinary books it will be a friend in need; and even the writer of a paper to be read before an assembly of veterinary surgeons can consult it with profit and benefit to his outlook.

We have long wanted a bibliography of current literature in the English language; and if future lists are as complete as the one given in the opening number, the new periodical will no doubt do good and valuable work. The first issue consists of 102 pages, and is well printed and attractive in appearance. G. M.

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